U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-261 962

Lake Marion: Berkeley, Calhoun, Clarendon, Orangeburg, and Sumter Counties, South Carolina

National Eutrophication Survey, Corvallis, Oreg

Prepared for

Corvallis Environmental Research Lab, Oreg

Aug 76

TECHNICAL REPORT DATA (Please read Instructions on the reverse before completing)		
1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Report on Lake Marion; Berkeley, Calhoun, Clarendon, Orangeburg, and Sumter Counties, South Carolina		5. REPORT DATE Prepared August 1976 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Anonymous (National Eutrophication Survey Staff)		8. PERFORMING ORGANIZATION REPORT NO. Working Paper # 434
9. PERFORMING ORGANIZATION NAME AND ADDRESS National Eutrophication Survey U.S. Environmental Protection Agency 200 S. W. 35th St. Corvallis, Oregon 97330		10. PROGRAM ELEMENT NO. 11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS Office of Research and Development U.S. Environmental Protection Agency 401 M Street, S. W. Washington, DC 20460		13. TYPE OF REPORT AND PERIOD COVERED Final - 1973 14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES
Prepared in cooperation with the U.S. Environmental Protection Agency, National Environmental Research Center, Las Vegas, Nevada 89114

16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
eutrophication lakes nutrients phosphorus nitrogen loading		05B 05C

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS (This Report)	21. NO. OF PAGES
Release unlimited		61
	20. SECURITY CLASS (This page)	22. PRICE 4.50

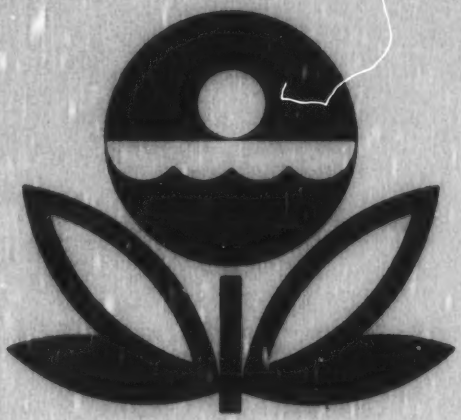
EPA Form 2220-1 (9-73)

013041

PB 261 962

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

WORKING PAPER SERIES



CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON

and

ENVIRONMENTAL MONITORING & SUPPORT LABORATORY - LAS VEGAS, NEVADA

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U. S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

699-440

REPORT

ON

LAKE MARION

BERKELEY, CALHOUN, CLARENDON, ORANGEBURG, AND SUMTER COUNTIES

SOUTH CAROLINA

EPA REGION IV

WORKING PAPER No. 434

WITH THE COOPERATION OF THE

SOUTH CAROLINA DEPARTMENT OF HEALTH AND

ENVIRONMENTAL CONTROL

AND THE

SOUTH CAROLINA NATIONAL GUARD

AUGUST, 1976

CONTENTS

	Page
Foreword	ii
List of South Carolina Study Lakes	iv
Lake and Drainage Area Map	v
Sections	
I. Conclusions	1
II. Lake and Drainage Basin Characteristics	5
III. Lake Water Quality Summary	6
IV. Nutrient Loadings	11
V. Literature Reviewed	21
VI. Appendices	22

FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's freshwater lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the South Carolina Department of Health and Environmental Control for professional involvement, to the South Carolina National Guard for conducting the tributary sampling phase of the Survey, and to those South Carolina wastewater treatment plant operators who voluntarily provided effluent samples and flow data.

The staff of the South Carolina Bureau of Wastewater and Stream Quality Control provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

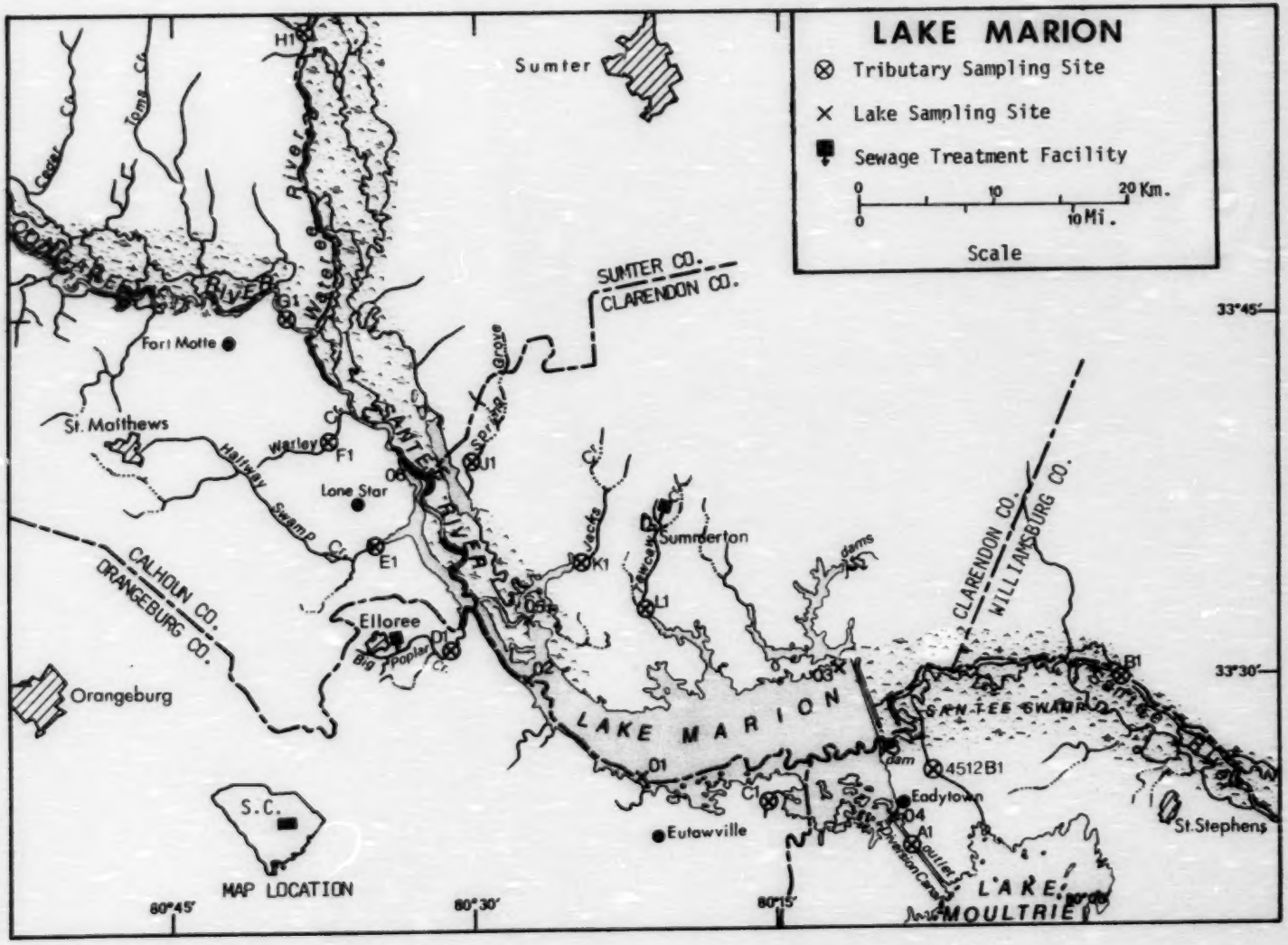
Major General Robert L. McCrady, the Adjutant General of South Carolina, and Project Officer Lt. Colonel John P. DuPre (Retired), who directed the volunteer efforts of the South Carolina National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF SOUTH CAROLINA

NAME	COUNTY
Clark Hill	Abbeville, McCormick, SC; Columbia, Elbert, Lincoln, McDuffie, Wilks, GA
Fishing Creek	Chester, Lancaster
Greenwood	Greenwood, Laurens, Newberry
Hartwell	Anderson, Oconee, Pickens, SC; Franklin, Hart, Stephens, GA
Keowee	Oconee, Pickens
Marion	Berkeley, Calhoun, Claredon, Orangeburg, Sumter
Moultrie	Berkeley
Murray	Lexington, Newberry, Richland, Saluda
Robinson	Chesterfield, Darlington
Saluda	Greenville, Pickens
Secession	Abbeville, Anderson
Wateree	Fairfield, Kershaw, Lancaster
William C. Bowen	Spartanburg
Wylie	York, SC; Gaston, Mecklenburg, NC


LAKE MARION
Tributary Sampling Site
Lake Sampling Site
Sewage Treatment Facility
0 10 20 Km.
0 10 Mi.
Scale
Sumter
SUMTER CO.
CLARENDON CO.
CLARENDON CO.
WILLIAMSBURG CO.
CALHOUN CO.
ORANGEBURG CO.
Fort Motte
St. Matthews
Lone Star
Summerton
Elloree
Orangeburg
Eutawville
Eadytown
St.Stephens
Santee River
Santee Swamp
LAKE MARION
LAKE MOULTRIE
Dam
Outlet
Tom's Creek
Cedar Creek
Halfway Swamp Cr.
Big Poplar Cr.
Lawsons Fork Cr.
Wateree River
Congaree River
Spring Grove
H1
G1
F1
E1
D1
K1
L1
U1
O1
C1
A1
4512B1
S.C.
MAP LOCATION
33°45'
33°30'
80°45'
80°30'
80°15'

LAKE MARION

STORET NO. 4506

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate Lake Marion is eutrophic. It ranked ninth in overall trophic quality when the 13 South Carolina lakes sampled in 1973 were compared using a combination of six parameters*. Eight of the lakes had less median total phosphorus and dissolved orthophosphorus, six had less median inorganic nitrogen, ten had less mean chlorophyll a, and nine had greater mean Secchi disc transparency. Marked depression of dissolved oxygen with depth occurred at sampling stations 1 and 3 in July.

Survey limnologists did not observe surface concentrations of algae but noted the occurrence of macrophytes in the shoreline shallows near stations 5 and 6 in July and stations 3, 4, 5, and 6 in September.

B. Rate-Limiting Nutrient:

The algal assay results indicate Lake Marion was phosphorus limited at the time the samples were collected (03/26-27/73). The lake data indicate phosphorus limitation at all sampling times.

C. Nutrient Controllability:

1. Point sources--The estimated phosphorus contribution of

* See Appendix A.

the listed point sources amounted to 44.9% of the total phosphorus load reaching Lake Marion during the sampling year. The indirect sources discharging in the Wateree Lake drainage contributed 23.9% of the total, the indirect sources in the Lake Murray drainage contributed 3.2%, and the five municipal plants in the Columbia metropolitan area collectively contributed 14.5%.

In this assessment of point-source phosphorus contributions, no accounting has been made for the 54 municipal sources in the Broad River drainage, the many privately-owned domestic facilities, or the many industrial discharges (see pages 15 - 16). Therefore, the proportion of the total phosphorus load contributed to Lake Marion by point sources must be much greater than the indicated 44.9%. In fact, if all of the phosphorus load estimated to have been contributed by the 54 more-distant municipal plants in the Broad River drainage reached the lake, the overall proportion of point-source contribution would be increased to 60% of the total load, and the apparent "non-point" phosphorus export rate of the Congaree River would be reduced to about that of the Wateree River (see below).

The phosphorus loading measured during the sampling year, 3.54 g/m^2, is over three times that proposed by Vollenweider (Vollenweider and Dillon, 1974) as a eutrophic loading (see page 20). However, Vollenweider's model probably does not apply to water bodies with short hydraulic retention times, and the mean hydrau-

lic retention time of Lake Marion is a relatively short 44 days. Nonetheless, the trophic condition of the lake is evidence of excessive nutrient loads.

It is calculated that 85% phosphorus removal at the listed point sources would reduce the loading to 2.19 $g/m^2/yr$, or about twice the eutrophic loading. However, considering all of the point sources impacting Lake Marion and the persistent phosphorus-limited condition of the lake, it is likely that a high degree of point-source phosphorus control would result in a significant improvement in the trophic condition of Lake Marion and benefit downstream Lake Moultrie* as well.

2. Non-point sources--The non-point phosphorus contribution of the sampled tributaries accounted for 54.4% of the total input to Lake Marion. The Congaree River load amounted to 38.4% of the total, the Wateree River contributed 14.5%, and the remaining seven tributaries collectively contributed 0.5%.

As discussed above, the non-point contribution of the Congaree River is believed to be overestimated. The phosphorus export rate of this stream was nearly twice that of the Wateree River, the only other tributary sampled with a drainage area of comparable size (see page 19). However, if the phosphorus load of 240,000 kg estimated to have been contributed by the municipal point sources in the Broad River drainage is subtracted from the "non-

* Working Paper No. 435.

point" load of the Congaree River, the export rate is reduced to 17 kg P/km^2/yr, a rate quite comparable to that of the Wateree River.

The phosphorus export rate of Tawcaw Creek was a relatively high 50 kg/km^2/yr. This higher rate indicates an underestimation of the Summerton point-source load. However, if the actual non-point export of the creek was 25 kg/km^2/yr, the additional load attributable to the point source would be about 950 kg, a relatively small amount compared to the overall point-source load.

During the Survey sampling year, over one-half of the area of Lake Marion was part of the Santee National Wildlife Refuge, a major Atlantic Flyway waterfowl wintering refuge. An additional 12 km^2 of adjacent land was flooded in the winter for waterfowl use, and most of that water was drained back into Lake Marion in the spring.

On the basis of information provided by the Refuge Manager (Strickland, 1976), the amounts of nutrients contributed to Lake Marion by migratory waterfowl were estimated (see page 12 for method of calculation).

Collectively, ducks and geese using the refuge added an estimated 800 kg P and 2,615 kg N during the sampling year and accounted for less than 0.1% of the total phosphorus and total nitrogen loads.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS†

A. Lake Morphometry††:

1. Surface area: 447.59 kilometers².
2. Mean depth: 4.0 meters.
3. Maximum depth: 23.4 meters.
4. Volume: 1,790.368 x 10^6 m^3.
5. Mean hydraulic retention time: 44 days (based on outflow).

B. Tributary and Outlet:
(See Appendix C for flow data)

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
Unnamed Creek C-1	11.2	0.094
Big Poplar Creek	38.3	0.330
Halfway Swamp Creek	169.4	1.480
Warley Creek	30.6	0.260
Congaree River	21,937.3	279.230
Wateree River	14,581.7	184.010
Spring Grove Creek	32.9	0.360
Jacks Creek	44.3	0.490
Tawcaw Creek	37.8	0.410
Minor tributaries & immediate drainage -	741.9	6.460
Total	37,625.4	473.224

2. Outlet -

Diversion Canal		409.390
Santee Old Canal }	38,073.0**	0.166
Santee River		60.290
Total		469.846

C. Precipitation***:

1. Year of sampling: 120.0 centimeters.
2. Mean annual: 113.8 centimeters.

---

† Table of metric conversions--Appendix B.
†† Martin and Hanson, 1966; maximum depth from Mast (1974).
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976".
** Includes area of lake.
*** See Working Paper No. 175.

III. LAKE WATER QUALITY SUMMARY

Lake Marion was sampled three times during the open-water season of 1973 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from a number of depths at six stations on the lake (see map, page v). During each visit, a single depth-integrated (4.6 m or near bottom to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the first visit, three 18.9-liter depth-integrated samples were composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 9.1 meters at station 1, 7.9 meters at station 2, 9.1 meters at station 3, 7.6 meters at station 4, 2.1 meters at station 5, and 4.0 meters at station 6.

The sampling results are presented in full in Appendix D and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR LAKE MARION
STORET CODE 4506

PARAMETER	1ST SAMPLING (3/26/73) 6 SITES RANGE	MEAN	MEDIAN	2ND SAMPLING (7/10/73) 6 SITES RANGE	MEAN	MEDIAN	3RD SAMPLING (9/22/73) 6 SITES RANGE	MEAN	MEDIAN
TEMP (C)	14.0 - 16.3	15.0	14.9	25.8 - 32.5	29.3	29.4	25.2 - 28.9	26.9	26.6
DISS OXY (MG/L)	8.6 - 10.7	9.1	8.9	0.1 - 9.9	6.3	6.4	3.8 - 7.8	5.6	5.6
CNDCTVY (MCROMO)	55. - 87.	67.	70.	50. - 80.	72.	72.	64. - 95.	80.	84.
PH (STAND UNITS)	7.2 - 7.8	7.4	7.7	6.0 - 8.7	7.1	6.9	6.2 - 8.1	6.7	6.7
TOT ALK (MG/L)	10. - 13.	11.	11.	10. - 33.	25.	27.	10. - 23.	15.	14.
TOT P (MG/L)	0.042 - 0.108	0.074	0.075	0.024 - 0.087	0.047	0.046	0.013 - 0.116	0.060	0.043
ORTHO P (MG/L)	0.007 - 0.018	0.012	0.012	0.004 - 0.030	0.009	0.007	0.004 - 0.024	0.013	0.011
NO2+NO3 (MG/L)	0.050 - 0.340	0.255	0.290	0.060 - 0.440	0.160	0.135	0.030 - 0.250	0.129	0.080
AMMONIA (MG/L)	0.030 - 0.060	0.047	0.050	0.080 - 0.430	0.140	0.120	0.030 - 0.110	0.074	0.080
KJEL N (MG/L)	0.200 - 0.700	0.405	0.400	0.400 - 1.200	0.755	0.700	0.300 - 1.100	0.576	0.600
INORG N (MG/L)	0.090 - 0.400	0.303	0.340	0.140 - 0.570	0.300	0.245	0.080 - 0.330	0.202	0.150
TOTAL N (MG/L)	0.540 - 0.840	0.660	0.665	0.560 - 1.330	0.915	0.875	0.360 - 1.300	0.705	0.790
CHLRPYL A (UG/L)	2.7 - 19.6	8.3	6.8	3.1 - 19.3	9.8	8.8	1.8 - 19.9	8.1	7.3
SECCHI (METERS)	0.4 - 0.9	0.6	0.5	0.6 - 1.5	0.9	0.9	0.3 - 1.4	0.7	0.6

B. Biological Characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
03/26/73	1. *Melosira sp.*	1,388
	2. Flagellates	505
	3. Pennate diatoms	473
	4. *Cryptomonas sp.*	189
	5. *Dactylococcopsis sp.*	178
	Other genera	705
	Total	3,438
07/10/73	1. *Lyngbya sp.*	1,154
	2. *Melosira sp.*	1,010
	3. *Dactylococcopsis sp.*	830
	4. Flagellates	397
	5. *Nitzschia sp.*	397
	Other genera	1,982
	Total	5,770
09/22/73	1. *Dactylococcopsis sp.*	1,485
	2. Flagellates	764
	3. *Lyngbya sp.*	679
	4. *Raphidiopsis sp.*	467
	5. *Anabaenopsis sp.*	339
	Other genera	2,122
	Total	5,856

2. Chlorophyll *a* -

Sampling Date	Station Number	Chlorophyll *a* (µg/l)
03/26/73	1	2.7
	2	3.0
	3	10.5
	4	10.7
	5	19.6
	6	3.1

Sampling Date	Station Number	Chlorophyll a (µg/l)
07/10/73	1	7.1
	2	12.0
	3	9.6
	4	8.0
	5	19.3
	6	3.1
09/22/73	1	6.5
	2	3.7
	3	8.5
	4	8.0
	5	-
	6	1.8

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

a. Stations 1 and 2 -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.018	0.302	5.0
0.010 P	0.028	0.302	7.6
0.020 P	0.038	0.302	8.8
0.050 P	0.068	0.302	9.5
0.025 P + 0.5 N	0.043	0.802	16.9
0.050 P + 1.0 N	0.068	1.302	25.3
1.0 N	0.018	1.302	5.2

b. Stations 3, 4, and 5 -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.015	0.258	3.2
0.010 P	0.025	0.258	4.1
0.020 P	0.035	0.258	4.2
0.050 P	0.065	0.258	4.1
0.025 P + 0.5 N	0.040	0.758	11.3
0.050 P + 1.0 N	0.065	1.258	23.8
1.0 N	0.015	1.258	3.2

c. Station 6 -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.017	0.265	4.4
0.010 P	0.027	0.265	7.7
0.020 P	0.037	0.265	7.7
0.050 P	0.067	0.265	8.1
0.025 P + 0.5 N	0.042	0.765	16.1
0.050 P + 1.0 N	0.067	1.265	26.4
1.0 N	0.017	1.265	4.5

2. Discussion -

The control yields of the assay alga, Selenastrum capricornutum, indicate that the potential primary productivity of Lake Marion was moderately high at the time the samples were collected (03/26 - 27/73). Also, increasing yields with increasing concentrations of orthophosphorus indicate that the lake was limited by phosphorus at that time. Note that the addition of only nitrogen resulted in yields not significantly greater than those of the controls.

The lake data also indicate phosphorus limitation. At all sampling times, the mean inorganic nitrogen/orthophosphorus ratios were 16/1 or greater, and phosphorus limitation would be expected.

IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the South Carolina National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for the high runoff month of January when two samples were collected. Sampling was begun in February, 1973, and was completed in February, 1974.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the South Carolina District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

Except for Big Poplar Creek, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings†. Tributary nutrient loads shown are those measured minus estimated point-source loads, if any.

The phosphorus load measured in Big Poplar Creek at station D-1 was 37% less than the estimated Elloree waste treatment plant load; therefore, the nutrient loads for the creek and the unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the means of the nutrient loads, in $kg/km^2/year$, at stations C-1, F-1, J-1, and K-1 and multiplying the means by the Big Poplar Creek and ZZ areas in km^2.

Estimates of the nutrient contributions of migratory ducks and geese are based on the following information provided by Refuge Manager

† See Working Paper No. 175.

Charles Strickland (1976): In 1973-74, common Canada goose-use-days totaled 1,062,600, duck-use-days totaled 10,372,400 (one-half of the ducks were mallards), and coot-use-days totaled 1,393,650.

In calculating the nutrient loads, the following assumptions were made:

1. Canada geese spend one-fourth of their time away from the refuge waters (Strickland, op. cit.; i.e., effective goose-use-days = 796,950).

2. Mallard ducks spend one-third of their time away from the refuge waters (i.e., effective mallard-use-days = 3,457,640).

3. The remaining ducks and the coots spend practically all of their time on the refuge waters and thus essentially recycle nutrients from the lake back to the lake.

4. All nutrients in feces deposited in the winter-flooded areas are input to Lake Marion when the areas are drained.

5. The physiology of waste excretion is similar among waterfowl, and the amount of feces produced is approximately proportional to body weight (Hutchinson, 1950).

6. The mean weight of common Canada geese is 3.870 kg and that of mallard ducks is 1.148 kg (Kortright, 1943).

7. Common Canada geese contribute 0.439 g total phosphorus and 1.435 g total nitrogen per goose-use-day (Manny et al., 1975).

The indirect municipal point-source loads leaving upstream Lake Murray*

* Working Paper No. 436.

were calculated by multiplying the nutrient loads leaving that lake (83,275 kg P and 1,927,285 kg N) by the fractions of the totals of the nutrient loads contributed by the point sources (0.600 for P and 0.309 for N). The indirect municipal point-source loads leaving upstream Wateree Lake* were calculated the same way (462,785 kg P x 0.817 and 4,512,345 kg N x 0.365).

In the following table, the municipal point sources listed include those within 65 kilometers of the confluence of the Congaree and Wateree rivers (i.e., upstream to the outlets of Lake Murray and Wateree Lake), including those discharging in the Broad River system within the 65 km limit (see map, page v). Of the listed municipal sources, the operator of the Elloree wastewater treatment plant provided monthly effluent samples but could not provide corresponding flow data, and the remaining plants were not sampled. Therefore, the nutrient loads from all of the plants listed were estimated at 1.134 kg P and 3.401 kg N/capita/year.

* Working Paper No. 440.

A. Waste Sources*:

1. Known municipal -

Name	Pop. Served	Treatment	Mean Flow (m^3/d)	Receiving Water
Camden	7,800	stab. pond	4,012.1	Wateree River
Cayce	6,800	ext. aer.	2,573.8	Congaree River
Cayce Airport	5,000	tr. filter	1,135.5	Airport Creek/ Congaree River
Columbia				
Metro	200,000	tr. filter aer. basins	83,270.0	Congaree River
E. Rich P.S.	25,000	ext. aer.	11,733.5	Gills Creek/ Congaree River
Spring Valley S.D.	980	ext. aer.	378.5	Jackson Creek/ Congaree River
Dept. Corr.	700	stab. pond	227.1	ditch/Broad River
Friarscate	2,670	stab. pond	984.1	Nichols Creek/ Broad River
Elloree	1,350	stab. pond	302.8	Big Poplar Creek/ Lake Marion
Irmo				
Whitehall #1	4,000	stab. pond	1,514.0	Kinley Creek/ Saluda River
Whitehall #2	3,073	stab. pond	1,163.1	Kinley Creek/ Saluda River
Whitehall #3	1,100	stab. pond	416.4	Trib./Saluda River
Coldstream	875	stab. pond	378.5	Rawls Creek/ Saluda River
Challedon	3,700	stab. pond	537.5	Trib./Saluda River
Challedon W.	1,250	stab. pond	473.1	Lorick Br./Saluda River
Coatesworth	1,777	stab. pond	412.6	Koon Br./Saluda River
Pineglen SD	300	stab. pond	113.6	ditch/Saluda River
Columbia - Gardendale	2,068	stab. pond	893.3	trib./Saluda River
Quail Valley SD	600	ext. aer.	227.1	Kinley Creek/ Saluda River
Lexington	1,600	ext. aer.	605.6	Twelvemile Creek/ Saluda River
County Hosp.	735	ext. aer.	189.2	Robb Senn Br./ Saluda River
Ridgeway #3	200	septic tank	75.7	Sawneys Creek/ Wateree River
St. Matthews				
#1	800	stab. pond	302.8	Antley Spring Br.
#2	650	stab. pond	246.0	Halfway Swamp Creek
Springdale SD	130	stab. pond	49.2	Sixmile Creek/ Congaree River
Summerton	1,505	stab. pond	569.6	Tawcaw Creek
West Columbia				
Hallmark	600	stab. pond	227.1	Lorick Br./Saluda River
Saluda Hills	1,600	stab. pond	605.6	Saluda River

* Foley, 1976.

In addition to the sources listed above, 54 municipal wastewater treatment plants (estimated population served ca. 212,000) discharge to the Broad River and its major tributary drainages (Enoree River, Tyger River, and Pacolet River) more than 65 kilometers upstream from the confluence of the Congaree and Wateree rivers. Since there is minimal regulation of the Broad River flow by impoundment, it is likely these more-distant point sources contributed significantly to the nutrient exports of the Congaree River at station G-1 (see map, page v).

Also, many privately-owned facilities treating domestic wastes are located in the Lake Marion drainage. Within the 65-kilometer limit, there are at least 136 such plants individually serving populations equal to or greater than 100 persons (estimated combined population served of about 127,000). Most of these smaller sources are located in the Columbia metropolitan area and thus contributed to the Congaree River nutrient exports, but 13 of the plants (estimated population served = 12,200) contributed to the Wateree River exports.

2. Indirect municipal -

Eleven municipal point sources discharge in the immediate Lake Murray drainage, and nine more discharge in the drainage upstream from the immediate drainage. A portion of the nutrient loads from these plants reaches Lake Marion via the Saluda River - Congaree River.

Seven municipal waste treatment plants discharge in the immediate drainage of Wateree Lake, and 25 more discharge in the drainage upstream from the immediate drainage. A portion of the nutrient loads from these sources reaches Lake Marion via the Wateree River - Congaree River.

3. Known industrial -

At least 34 industrial treatment facilities with a combined design flow of 42,900 m^3/day discharge in the Lake Marion drainage within a 65-kilometer radius of the confluence of the Congaree and Wateree rivers, and many more discharge in the Broad River drainage beyond the 65-km limit.

The nutrient significance of these sources is not known.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/ yr	% of total
a. Tributaries (non-point load) -		
Unnamed Creek C-1	280	<0.1
Big Poplar Creek	825	<0.1
Halfway Swamp Creek	2,200	0.1
Warley Creek	525	<0.1
Congaree River	608,250	38.4
Wateree River	229,445	14.5
Spring Grove Creek	930	<0.1
Jacks Creek	695	<0.1
TawCaw Creek	1,890	0.1
b. Minor tributaries & immediate drainage (non-point load) -	15,950	1.0
c. Known municipal STP's -		
Camden	8,845	0.6
Cayce	7,710	0.5
Cayce Airport	5,670	0.4
Columbia (5 plants)	229,350	14.5
Elloree	1,530	0.1
Irmo (10 plants)	21,255	1.3
Lexington (2 plants)	2,650	0.2
Ridgeway #3	225	<0.1
St. Matthews (2 plants)	1,645	0.1
Springdale SD	145	<0.1
Summerton	1,705	0.1
West Columbia (2 plants)	2,495	0.2
Indirect - Lake Murray drainage	49,965	3.2
Indirect - Wateree Lake drainage	378,095	23.9
d. Septic tanks* -	1,900	0.1
e. Industrial - Unknown	?	-
f. Migratory waterfowl -		
Ducks	450	<0.1
Geese	350	<0.1
g. Direct precipitation** -	7,835	0.5
Total	1,582,810	100.0

2. Outputs -

Lake outlet - Diversion Canal	587,860
Santee Old Canal	260
Santee River	94,490
Total	682,610

3. Net annual P accumulation - 900,200 kg.

* Estimate based on 260 lakeshore dwellings and 38 campgrounds, parks, and lodges; see Working Paper No. 175.
** See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/ yr	% of total
a. Tributaries (non-point load) -		
Unnamed Creek C-1	3,220	<0.1
Big Poplar Creek	12,870	0.1
Halfway Swamp Creek	29,945	0.2
Warley Creek	11,695	0.1
Congaree River	4,302,510	31.6
Wateree River	5,300,740	38.9
Spring Grove Creek	12,610	0.1
Jacks Creek	12,905	0.1
Tawcaw Creek	16,980	0.1
b. Minor tributaries & immediate drainage (non-point load) -	249,280	1.8
c. Known municipal STP's -		
Camden	26,530	0.2
Cayce	23,125	0.2
Cayce Airport	17,005	0.1
Columbia (5 plants)	780,020	5.7
Elloree	4,590	<0.1
Irmo (10 plants)	63,745	0.5
Lexington (2 plants)	7,940	<0.1
Ridgeway #3	680	<0.1
St. Matthews (2 plants)	4,930	<0.1
Springdale SD	440	<0.1
Summerton	5,120	<0.1
West Columbia (2 plants)	7,480	<0.1
Indirect - Lake Murray drainage	595,530	4.4
Indirect - Wateree Lake drainage	1,647,005	12.1
d. Septic tanks* -	7,145	<0.1
e. Industrial - Unknown	?	-
f. Migratory waterfowl -		
Ducks	1,470	<0.1
Geese	1,145	<0.1
g. Direct precipitation** -	483,220	3.5
Total	13,629,875	100.0

2. Outputs -

Lake outlet -	Diversion Canal	8,822,160
	Santee Old Canal	2,695
	Santee River	1,673,445
	Total	10,498,300

3. Net annual N accumulation - 3,131,575 kg.

* Estimate based on 260 lakeshore dwellings and 38 campgrounds, parks, and lodges; see Working Paper No. 175.
** See Working Paper No. 175.

D. Mean Annual Non-point Nutrient Export by Subdrainage Area:

Tributary	kg P/km²/yr	kg N/km²/yr
Unnamed Creek C-1	25	288
Halfway Swamp Creek	13	177
Warley Creek	17	382
Congaree River	28	196
Wateree River	16	364
Spring Grove Creek	28	383
Jacks Creek	16	291
Tawcaw Creek	50	449

E. Yearly Loads:

In the following table, the existing phosphorus loadings are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" loading is one at which the receiving water would become eutrophic or remain eutrophic; his "permissible" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic loading would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
grams/m^2/yr	3.54	2.01	30.5	7.0

Vollenweider phosphorus loadings ($g/m^2/yr$) based on mean depth and mean hydraulic retention time of Lake Marion:	
"Dangerous" (eutrophic loading)	1.10
"Permissible" (oligotrophic loading)	0.55

V. LITERATURE REVIEWED

Foley, John R., 1976. Personal communication (permitted point sources in the Lake Marion drainage). SC Dept. of Health & Env. Contr., Columbia.

Hutchinson, George Evelyn, 1950. Biogeochemistry of vertebrate excretion. Bull. Amer. Mus. Nat. Hist. 96: 1-554.

Kortright, Francis H., 1943. The ducks, geese and swans of North America (2nd ed.). Amer. Wildlife Inst., Wash., DC.

Manny, B. A., R. G. Wetzel, and W. D. Johnson, 1975. Annual contribution of carbon, nitrogen and phosphorus by migrant Canada geese to a hard-water lake. Verh. Int. Ver. Limnol. 19: 949-951.

Martin, R. O. R., and Ronald L. Hanson, 1966. Reservoirs in the United States. Water Supply Paper 1838, U.S. Geol. Surv., Wash., DC.

Mast, G. Nelson, 1974. Personal communication (maximum depth). SC Dept. of Health & Env. Contr., Columbus.

Strickland, Charles (Manager), 1976. Personal communication (waterfowl-use-days - lakes Marion and Moultrie; habits of refuge geese). Santee Natl. Wildlife Refuge, Summerton.

Vollenweider, R. A., and P. J. Dillon, 1974. The application of the phosphorus loading concept to eutrophication research. Natl. Res. Council of Canada Publ. No. 13690, Canada Centre for Inland Waters, Burlington, Ontario.

VI. APPENDICES

APPENDIX A

LAKE RANKINGS

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DC	MEDIAN DISS ORTHO P
4503	FISHING CREEK RESERVOIR	0.143	0.535	483.000	2.811	10.200	0.051
4504	LAKE GREENWOOD	0.061	0.470	463.917	8.150	15.000	0.011
4505	LAKE HARTWELL	0.013	0.130	422.000	6.157	15.000	0.004
4506	LAKE MARION	0.055	0.280	470.176	8.728	14.900	0.010
4507	LAKE MURRAY	0.024	0.260	424.905	6.478	15.000	0.007
4508	LAKE ROBINSON	0.014	0.260	458.778	8.611	14.000	0.005
4510	LAKE WATEREE	0.094	0.450	475.667	8.408	14.100	0.034
4511	LAKE WYLIE	0.045	0.380	462.222	5.422	14.800	0.013
4512	LAKE MOULTRIE	0.026	0.200	455.36[illegible]	8.800	11.200	0.006
4513	LAKE KEOWEE	0.008	0.170	371.750	2.833	15.000	0.003
4514	LAKE SECESSION	0.057	0.355	462.778	10.722	15.000	0.006
4515	SALUDA LAKE	0.046	0.230	476.833	1.517	10.800	0.006
4516	LAKE WILLIAM C. BOWEN	0.022	0.360	459.889	3.911	15.000	0.007

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P	INDEX NO
4503	FISHING CREEK RESERVOIR	0 (0)	0 (0)	0 (0)	92 (11)	100 (12)	0 (0)	192
4504	LAKE GREENWOOD	17 (2)	8 (1)	33 (4)	42 (5)	21 (0)	25 (3)	146
4505	LAKE HARTWELL	92 (11)	100 (12)	92 (11)	58 (7)	21 (0)	92 (11)	455
4506	LAKE MARION	33 (4)	50 (6)	25 (3)	17 (2)	50 (6)	33 (4)	208
4507	LAKE MURRAY	67 (8)	62 (7)	83 (10)	50 (6)	21 (0)	46 (5)	329
4508	LAKE ROBINSON	83 (10)	62 (7)	67 (8)	25 (3)	75 (9)	83 (10)	395
4510	LAKE WATEREE	8 (1)	17 (2)	17 (2)	33 (4)	67 (8)	8 (1)	150
4511	LAKE WYLIE	50 (6)	25 (3)	50 (6)	67 (8)	58 (7)	17 (2)	267
4512	LAKE MOULTRIE	58 (7)	83 (10)	75 (9)	8 (1)	83 (10)	71 (8)	378
4513	LAKE KEOWEE	100 (12)	92 (11)	100 (12)	83 (10)	21 (0)	100 (12)	496
4514	LAKE SECESSION	25 (3)	42 (5)	42 (5)	0 (0)	21 (0)	58 (7)	188
4515	SALUDA LAKE	42 (5)	75 (9)	8 (1)	100 (12)	92 (11)	71 (8)	388
4516	LAKE WILLIAM C. BOWEN	75 (9)	33 (4)	58 (7)	75 (9)	21 (0)	46 (5)	308

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	4513	LAKE KEOWEE	496
2	4505	LAKE HARTWELL	455
3	4508	LAKE ROBINSON	395
4	4515	SALUDA LAKE	388
5	4512	LAKE MOULTRIE	378
6	4507	LAKE MURRAY	329
7	4516	LAKE WILLIAM C. BOWEN	308
8	4511	LAKE WYLIE	267
9	4506	LAKE MARION	208
10	4503	FISHING CREEK RESERVOIR	192
11	4514	LAKE SECESSION	188
12	4510	LAKE WATEREE	150
13	4504	LAKE GREENWOOD	146

APPENDIX B

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX C

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR SOUTH CAROLINA 04/27/76

LAKE CODE 4506 LAKE MARION

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 38073.0

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
4506A1	38073.0	485.88	542.38	576.27	519.78	412.43	361.58	333.33	341.81	316.38	310.73	338.98	382.77	409.39
4506B1	38073.0	56.92	103.36	155.74	122.61	40.78	24.32	20.76	24.92	53.52	59.47	28.03	36.81	60.29
4506C1	11.2	0.113	0.142	0.170	0.142	0.085	0.057	0.057	0.057	0.057	0.085	0.085	0.085	0.094
4506D1	38.3	0.40	0.51	0.59	0.45	0.31	0.23	0.23	0.23	0.20	0.25	0.28	0.34	0.33
4506E1	169.4	1.78	2.27	2.63	2.07	1.36	0.99	0.99	0.96	0.85	1.13	1.27	1.50	1.48
4506F1	30.6	0.31	0.40	0.48	0.37	0.25	0.17	0.17	0.17	0.14	0.20	0.23	0.28	0.26
4506G1	21937.3	331.31	387.94	416.26	356.79	247.49	222.57	227.38	237.58	208.98	227.10	228.52	266.18	279.23
4506H1	14581.7	240.69	263.63	278.64	260.80	165.65	149.51	130.26	135.64	139.04	140.45	149.23	161.12	184.01
4506J1	32.9	0.42	0.48	0.51	0.40	0.34	0.25	0.28	0.28	0.25	0.34	0.34	0.37	0.36
4506K1	44.3	0.57	0.65	0.68	0.54	0.45	0.37	0.40	0.37	0.37	0.45	0.48	0.51	0.49
4506L1	37.8	0.48	0.57	0.57	0.45	0.40	0.31	0.34	0.31	0.31	0.37	0.40	0.42	0.41
4506ZZ	740.7	7.84	9.94	11.50	9.03	5.92	4.28	4.28	4.19	3.65	4.98	5.52	6.60	6.46

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 38073.0
SUM OF SUB-DRAINAGE AREAS = 37624.2

TOTAL FLOW IN = 5691.53
TOTAL FLOW OUT = 5649.54

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
4506A1	2	73	775.882	25	739.070				
	3	73	741.901	20	645.624				
	4	73	764.555	15	838.178				
	5	73	492.713	20	421.921				
	6	73	807.030	10	993.921				
	7	73	498.376	10	495.545				
	8	73	407.762	12	515.366				
	9	73	419.089	10	345.465				
	10	73	232.198	12	220.871				
	11	73	202.182	11	216.907				
	12	73	396.436	10	356.792				
	1	74	736.238	13	792.872	27	705.089		
	2	74	756.060	17	651.287				
4506B1	2	73	614.476	25	19.822				
	3	73	300.158	20	710.753				
	4	73	625.802	15	676.772				
	5	73	15.914	20	15.688				
	6	73	334.139	10	169.618				
	7	73	18.689	10	17.330				
	8	73	15.008	12	15.716				
	9	73	15.008	10	15.065				
	10	73	15.008	12	15.008				
	11	73	14.725	11	14.158				
	12	73	14.442	10	14.158				
	1	74	14.158	13	14.158	27	14.158		
	2	74	220.588	17	487.050				

TRIBUTARY FLOW INFORMATION FOR SOUTH CAROLINA 04/27/76

LAKE CODE 4506 LAKE MARION

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
4506C1	2	73	0.481	25	0.227				
	3	73	0.255	20	0.142				
	4	73	0.311	15	0.142				
	5	73	0.113	20	0.028				
	6	73	0.311	10	0.057				
	7	73	0.142	10	0.085				
	8	73	0.085	12	0.028				
	9	73	0.085	10	0.028				
	10	73	0.085	12	0.028				
	11	73	0.057	11	0.057				
	12	73	0.142	10	0.142				
	1	74	0.198	13	0.085	27	0.057		
	2	74	0.425	17	0.963				
4506D1	2	73	1.671	27	0.736				
	3	73	0.850	20	0.510				
	4	73	1.048	18	0.481				
	5	73	0.425	21	0.113				
	6	73	1.048	17	1.557				
	7	73	0.510	22	0.142				
	8	73	0.340	19	0.566				
	9	73	0.255	20	0.057				
	10	73	0.142	19	0.057				
	11	73	0.113	18	0.057				
	12	73	0.255	13	0.113				
	1	74	0.566	4	0.255	18	0.255		
	2	74	1.416	1	0.850				
4506E1	2	73	7.419	27	3.115				
	3	73	3.710	20	2.322				
	4	73	4.644	18	1.841				
	5	73	1.841	21	0.453				
	6	73	4.644	17	7.362				
	7	73	2.209	22	0.566				
	8	73	1.472	19	1.756				
	9	73	1.104	20	0.283				
	10	73	0.708	19	0.283				
	11	73	0.566	18	0.340				
	12	73	1.189	13	0.311				
	1	74	2.407	4	1.416	18	1.104		
	2	74	6.286	1	3.681				
4506F1	2	73	1.331	27	0.566				
	3	73	0.680	20	0.425				
	4	73	0.850	18	0.283				
	5	73	0.340	21	0.085				
	6	73	0.850	17	1.274				
	7	73	0.396	22	0.113				
	8	73	0.255	19	0.283				
	9	73	0.198	20	0.057				
	10	73	0.142	19	0.057				
	11	73	0.113	18	0.057				
	12	73	0.227	13	0.085				
	1	74	0.425	4	0.255	18	0.198		
	2	74	1.133	1	0.680				

TRIBUTARY FLOW INFORMATION FOR SOUTH CAROLINA 04/27/76

LAKE CODE 4506 LAKE MARION

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
4506G1	2	73	710.753	27	328.475				
	3	73	622.970	20	1268.595				
	4	73	781.545	18	461.564				
	5	73	404.931	21	262.497				
	6	73	574.832	17	1158.159				
	7	73	282.602	22	161.123				
	8	73	265.612	19	180.590				
	9	73	305.822	20	279.487				
	10	73	193.970	19	113.267				
	11	73	135.071	18	163.388				
	12	73	178.396	13	239.277				
	1	74	597.485	4	905.139	18	356.792		
	2	74	699.426	1	770.218				
4506M1	2	73	453.869	9	506.871				
	3	73	455.901	11	501.208				
	4	73	515.366	14	504.040				
	5	73	243.242	12	283.168				
	6	73	387.941	15	447.406				
	7	73	177.830	17	208.412				
	8	73	157.158	17	103.640				
	9	73	162.822	17	176.414				
	10	73	86.083	17	42.475				
	11	73	86.650	20	33.980				
	12	73	155.743	19	198.218				
	1	74	256.551	9	424.753	23	257.117		
	2	74	276.656	6	278.354				
4506J1	2	73	1.444	24	0.566				
	3	73	0.708	24	0.595				
	4	73	0.906	14	0.651				
	5	73	0.368	21	0.340				
	6	73	0.906	21	0.453				
	7	73	0.425	20	0.283				
	8	73	0.283	12	0.340				
	9	73	0.227	17	0.283				
	10	73	0.170	22	0.283				
	11	73	0.142	26	0.255				
	12	73	0.255	20	0.283				
	1	74	0.566	17	0.340	31	0.963		
	2	74	1.218	15	1.416				
4506K1	2	73	1.926	24	0.765				
	3	73	0.963	24	0.736				
	4	73	1.218	14	0.878				
	5	73	0.481	21	0.453				
	6	73	1.218	21	0.623				
	7	73	0.595	20	0.396				
	8	73	0.396	12	0.510				
	9	73	0.283	17	0.425				
	10	73	0.227	22	0.368				
	11	73	0.198	26	0.340				
	12	73	0.340	20	0.425				
	1	74	0.623	17	0.453	31	1.274		
	2	74	1.642	15	1.926				

TRIBUTARY FLOW INFORMATION FOR SOUTH CAROLINA 04/27/76

LAKE CODE 4506 LAKE MARION

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
4506L1	2	73	1.642	24	0.651				
	3	73	0.821	24	0.623				
	4	73	1.019	14	0.736				
	5	73	0.425	21	0.396				
	6	73	1.019	21	0.538				
	7	73	0.510	20	0.340				
	8	73	0.340	12	0.425				
	9	73	0.255	20	0.340				
	10	73	0.198	22	0.425				
	11	73	0.142	26	0.368				
	12	73	0.283	20	0.396				
	1	74	0.510	17	0.453	31	1.104		
	2	74	1.416	15	1.642				
4506ZZ	2	73	25.485	25	14.158				
	3	73	16.141	20	9.628				
	4	73	20.247	15	11.327				
	5	73	8.070	20	2.407				
	6	73	19.822	18	28.317				
	7	73	9.713	20	2.265				
	8	73	6.371	15	1.614				
	9	73	4.870	15	1.416				
	10	73	2.832	15	1.557				
	11	73	11.044	15	1.699				
	12	73	8.495	15	5.663				
	1	74	11.327	15	9.911	18	4.814		
	2	74	27.467	15	32.281				

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 76/04/27

450601
33 26 01.0 080 21 55.0 3
LAKE MARION
45075 SOUTH CAROLINA
030892

11EPALES 2111202
0033 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/03/26	16 10	0000	14.6		14	55	7.40	11	0.050	0.400	0.290	0.013
	16 10	0004	14.6	8.6		55	7.30	13	0.050	0.300	0.300	0.013
	16 10	0010	14.6	8.8		55	7.30	11	0.050	0.300	0.300	0.013
73/07/10	12 30	0000	29.6	9.3	32	80	8.10	28	0.110	1.200	0.080	0.010
	12 30	0005	29.5	7.5		76	7.10	30	0.090	0.800	0.100	0.008
	12 30	0015	28.7	4.5		79	6.70	31	0.140	0.600	0.150	0.008
	12 30	0030	25.8	1.0		80	6.50	33	0.290	0.500	0.260	0.008
73/09/22	11 25	0000	26.1		15	74	7.30	22	0.100	1.100	0.200	0.018
	11 25	0005	26.0	5.6		74	6.90	23	0.070	0.600	0.190	0.013
	11 25	0013	25.9	6.0		73	6.70	15	0.080	0.600	0.200	0.011

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/03/26	16 10	0000	0.107	2.7
	16 10	0004	0.103	
	16 10	0010	0.108	
73/07/10	12 30	0000	0.067	7.1
	12 30	0005	0.055	
	12 30	0015	0.040	
	12 30	0030	0.045	
73/09/22	11 25	0000	0.110	6.5
	11 25	0005	0.095	
	11 25	0013	0.100	

STORET RETRIEVAL DATE 76/04/27

450602
33 30 17.0 080 27 40.0 3
LAKE MARION
45027 SOUTH CAROLINA
030892

11EPALES 2111202
0028 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/03/26	16	35 0000	14.5			55	7.20	11	0.040	0.400	0.300	0.013
	16	35 0004	14.5	8.8		55	7.20	12	0.050	0.300	0.290	0.013
	16	35 0015	14.6	8.6		58	7.20	12	0.050	0.300	0.290	0.011
	16	35 0024	14.6	8.6		58	7.20	10	0.060	0.300	0.310	0.012
73/07/10	14	55 0000	30.8	9.9	36	75	8.70	31	0.120	1.100	0.100	0.008
	14	55 0004	30.0	8.2		75	7.00	32	0.110	0.800	0.140	0.006
	14	55 0015	28.8	5.9		72	6.00	31	0.120	0.400	0.170	0.007
	14	55 0026	28.4	4.6		73	6.60	30	0.150	0.500	0.260	0.008
73/09/22	11	45 0000	25.7		12	66	6.30	12	0.100	0.900	0.230	0.023
	11	45 0005	25.6	4.8		66	6.40	14	0.100	0.600	0.230	0.021
	11	45 0015	25.5	4.2		67	6.30	15	0.100	0.800	0.230	0.023
	11	45 0020	25.4	4.6		64	6.30	14	0.100	0.600	0.230	0.020

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/03/26	16	35 0000	0.092	3.0
	16	35 0004	0.090	
	16	35 0015	0.082	
	16	35 0024	0.089	
73/07/10	14	55 0000	0.065	12.0
	14	55 0004	0.057	
	14	55 0015	0.051	
	14	55 0026	0.073	
73/09/22	11	45 0000	0.116	3.7
	11	45 0005	0.097	
	11	45 0015	0.100	
	11	45 0020	0.093	

STORET RETRIEVAL DATE 76/04/27

450603
33 31 10.0 080 11 55.0 3
LAKE MARION
45027 SOUTH CAROLINA
030591

11EPALES 2111202
0034 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/03/27	10 00	0000	15.4		23	87	7.80	11	0.050	0.500	0.210	0.007
	10 00	0006	15.9	9.2		75	7.80	11	0.040	0.400	0.180	0.007
	10 00	0015	15.8	9.0		80	7.80	10	0.050	0.400	0.180	0.009
	10 00	0030	15.8	8.8		70	7.80	11	0.050	0.500	0.190	0.009
73/07/10	11 15	0000	31.0	8.2	60	75	8.30	23	0.130	1.100	0.080	0.011
	11 15	0005	30.8	8.0		70	7.60	23	0.080	0.700	0.060	0.005
	11 15	0015	29.8	5.6		70	6.80	22	0.090	0.600	0.070	0.004
	11 15	0028	26.7	0.1		80	6.50	31	0.430	1.000	0.070	0.006
73/09/21	15 45	0000	28.7		55	89	8.10	12	0.040	0.500	0.040	0.004
	15 45	0005	27.9	7.2		86	7.30	14	0.060	0.400	0.040	0.011
	15 45	0015	27.7	5.6		87	6.90	15	0.080	0.400	0.040	0.007
	15 45	0025	27.7	5.2		87	6.90	16	0.110	0.400	0.040	0.007

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/03/27	10 00	0000	0.042	10.5
	10 00	0006	0.049	
	10 00	0015	0.052	
	10 00	0030	0.055	
73/07/10	11 15	0000	0.041	9.6
	11 15	0005	0.024	
	11 15	0015	0.024	
	11 15	0028	0.028	
73/09/21	15 45	0000	0.017	8.5
	15 45	0005	0.016	
	15 45	0015	0.013	
	15 45	0025	0.017	

STORET RETRIEVAL DATE 76/04/27

450604
33 24 10.0 080 09 15.0 3
LAKE MARION
45015 SOUTH CAROLINA

030892

11EPALES 2111202
0029 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/03/27	10 30	0000	15.3		18	70	7.80	11	0.060	0.500	0.300	0.012
	10 30	0003	15.3	9.4		70	7.80	10	0.050	0.400	0.290	0.011
	10 30	0015	15.4	9.4		70	7.80	10	0.040	0.400	0.290	0.012
	10 30	0025	15.4	9.4		70	7.80	10K	0.030	0.400	0.280	0.011
73/07/10	11 50	0000	30.2	6.8	32	72	7.10	26	0.110	1.200	0.130	0.007
	11 50	0012	29.3	6.8		72	7.00	25	0.100	0.700	0.150	0.005
	11 50	0015	28.9	6.4		70	6.90	26	0.100	0.600	0.140	0.005
	11 50	0025	28.5	6.4		72	6.90	28	0.140	0.400	0.160	0.005
73/09/21	15 30	0000	28.9		48	92	6.80	10	0.070	0.300	0.080	0.005
	15 30	0005	28.4	7.6		92	6.50	10K	0.030	0.300	0.060	0.005
	15 30	0015	28.3	7.8		91	6.70	10K	0.030	0.300	0.060	0.007

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/03/27	10 30	0000	0.071	10.7
	10 30	0003	0.069	
	10 30	0015	0.064	
	10 30	0025	0.066	
73/07/10	11 50	0000	0.036	8.0
	11 50	0012	0.027	
	11 50	0015	0.024	
	11 50	0025	0.025	
73/09/21	15 30	0000	0.017	8.0
	15 30	0005	0.020	
	15 30	0015	0.021	

A VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/04/27

450605
33 34 06.0 080 26 30.0 3
LAKE MARION
45075 SOUTH CAROLINA

030892

11EPALES 2111202
0010 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/03/27	13 00	0000	16.3		37	62	7.80	10K	0.040	0.700	0.050	0.007
	13 00	0007	15.7	10.7		65	7.80	10K	0.040	0.600	0.050	0.010
73/07/10	15 30	0000	32.5	8.1	36	53	7.30	10K	0.130	1.100	0.100	0.006
	15 30	0007	30.5	6.0		50K	6.60	11	0.130	0.800	0.100	0.009
73/09/22	12 05	0000	26.9	6.4	35	84	6.40	18	0.050	0.800	0.040	0.010
	12 05	0005	26.6	4.4		95	6.30	18	0.050	0.600	0.030	0.009

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/03/27	13 00	0000	0.042	19.6
	13 00	0007	0.043	
73/07/10	15 30	0000	0.047	19.3
	15 30	0007	0.049	
73/09/22	12 05	0000	0.041	19.9
	12 05	0005	0.043	

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/04/27

450606
33 38 40.0 080 32 15.0 3
LAKE MARION
45085 SOUTH CAROLINA
030892

11EPALES 2111202
0016 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/03/27	13 30	0000	14.0		18	70	7.60	10K	0.060	0.500	0.340	0.018
	13 30	0004	14.0	8.8		80	7.60	10K	0.050	0.300	0.330	0.016
	13 30	0012	14.0	9.3		80	7.70	10K	0.040	0.200	0.340	0.016
73/07/10	15 55	0000	28.2	5.9	24	70	6.70	19	0.130	0.600	0.440	0.030
	15 55	0013	28.2	6.1		70	6.80	19	0.110	0.400	0.440	0.024
73/09/22	12 25	0000	25.2	3.8	12	67	6.20	11	0.080	0.600	0.250	0.024

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/03/27	13 30	0000	0.080	3.1
	13 30	0004	0.085	
	13 30	0012	0.085	
73/07/10	15 55	0000	0.085	3.1
	15 55	0013	0.087	
73/09/22	12 25	0000	0.097	1.8

K VALUE KNOWN TO BE
LESS THAN INDICATED

APPENDIX E

TRIBUTARY and WASTEWATER TREATMENT PLANT DATA

STORET RETRIEVAL DATE 76/04/27

4506A1
33 23 00.0 080 08 00.0 4
DIVERSION CANAL
45 BERKELEY CO HWY
0/LAKE MARION 030892
ST HWY 45 BRDG
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/02/25	11 30		0.260	0.440	0.040	0.024	0.060
73/03/20	16 50		0.240	0.390	0.005K	0.009	0.055
73/04/15	10 05		0.220	0.380	0.030	0.035	0.072
73/05/20	10 00		0.052	0.440	0.021	0.007	0.030
73/06/10	11 45		0.048	1.890	0.099	0.005K	0.030
73/07/10	12 17		0.096	0.350	0.048	0.016	0.035
73/08/12	10 20		0.025	0.690	0.035	0.013	0.025
73/09/10	15 12		0.027	0.390	0.022	0.005K	0.025
73/10/12	15 22		0.150	0.560	0.060	0.008	0.035
73/11/11	10 38		0.112	0.700	0.024	0.005K	0.030
73/12/10	12 30		0.048	0.200	0.028	0.005K	0.025
74/01/13	10 15		0.330	0.500	0.068	0.020	0.060
74/01/27	12 00		0.276	0.200	0.024	0.016	0.040
74/02/17	11 00		0.288	0.300	0.035	0.015	0.120

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/04/27

450681
33 29 30.0 079 58 00.0 4
SANTEE RIVER
45 BERKELEY CO HWY
O/LAKE MARION 030891
US HWY 52 BRDG NW OF ST STEPHEN
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/02/25	12 20		0.132	0.520	0.097	0.026	0.070
73/03/20	17 30		0.198	0.400	0.006	0.012	0.055
73/04/15	10 40		0.220	0.350	0.020	0.025	0.060
73/05/20	10 30		0.115	0.770	0.039	0.013	0.055
73/06/10	12 30		0.170	3.400	0.470	0.019	0.050
73/07/10	12 15		0.210	0.780	0.130	0.033	0.075
73/08/12	10 50		0.120	1.000	0.054	0.016	0.040
73/09/10	15 10		0.130	0.300	0.050	0.015	0.035
73/10/12	15 30		0.210	0.360	0.054	0.013	0.040
73/11/11	11 05		0.108	0.350	0.022	0.018	0.022
73/12/10	13 05		0.044	0.100	0.028	0.008	0.025
74/01/13	11 10		0.156	0.500	0.044	0.012	0.045
74/01/27	12 30		0.208	0.200	0.032	0.012	0.030
74/02/17	13 30		0.288	0.300	0.030	0.010	0.050

STORET RETRIEVAL DATE 76/06/22

451281
33 26 00.0 080 07 00.0 4
OLD CANAL
45 BERKELEY CO HWY
T/LAKE MOULTRIE and O/Lake Marion 030892
ST HWY 45 BRDG 2 MI E OF EADYTOWN
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/02/25	11	45	0.010K	0.150	0.042	0.006	0.015
73/03/20	17	05	0.010K	0.690	0.030	0.015	0.035
73/04/15	10	20	0.010K	0.150	0.010	0.008	0.020
73/05/20	10	15	0.010K	0.130	0.010	0.012	0.030
73/06/10	12	05	0.019	1.300	0.270	0.028	0.080
73/07/10	12	30	0.010K	0.460	0.030	0.015	0.065
73/08/12	10	35	0.010K	1.050	0.046	0.024	0.055
73/09/10	15	20	0.010K	0.580	0.005K	0.005K	0.090
73/10/12	15	10	0.025	0.560	0.036	0.015	0.065
73/11/11	10	50	0.012	0.900	0.016	0.016	
73/12/10	12	50	0.010K	0.200	0.012	0.020	0.050
74/01/13	10	30	0.024	0.300	0.020	0.020	0.082
74/01/27	10	35	0.016	0.200	0.016	0.016	0.030
74/02/17	11	20	0.032	0.300	0.050	0.005	0.015

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/04/27

4506C1
33 25 00.0 080 15 30.0 4
UNNAMED CREEK
45 ORANGEBURG CO HW
T/LAKE MARION 030892
RD BRDG 5 MI ENE OF EUTAWVILLE
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/02/25	11 00		0.132	0.730	0.037	0.005K	0.050
73/03/20	15 55		0.046	1.380	0.016	0.005K	0.075
73/04/15	09 40		0.010K	0.690	0.011	0.010	0.070
73/05/20	09 30		0.010K	0.840	0.007	0.007	0.075
73/06/10	11 25		0.019	1.300	0.082	0.028	0.090
73/07/10	11 45		0.010K	1.050	0.027	0.023	0.115
73/08/12	10 00		0.010K	2.100	0.035	0.085	0.090
73/09/10	14 50		0.019	1.400	0.023	0.021	0.160
73/10/12	14 40		0.010K	2.200	0.024	0.016	0.185
73/11/11	10 15		0.020	0.950	0.012	0.020	0.095
73/12/10	12 15		0.016	0.700	0.024	0.020	0.130
74/01/13			0.020	0.600	0.016	0.012	0.070
74/01/27	11 30		0.012	0.600	0.008	0.008	0.070
74/02/17	10 30		0.032	0.700	0.020	0.010	0.085

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/04/27

450601
33 31 00.0 080 30 30.0 4
BROWNING BRANCH
45 ORANGEBURG CO HW
T/LAKE MARION 030892
ST HWY 105 BRDG 4 MI E OF ELLOREE
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/02/27	14 25		0.820	0.340	0.046	0.016	0.035
73/03/20	09 00		0.490	0.600	0.014	0.034	0.065
73/04/18	14 00		0.520	0.405	0.016	0.046	0.075
73/05/21	10 20		0.010K	0.420	0.023	0.054	0.090
73/06/17	09 00		0.620	0.920	0.042	0.060	0.155
73/07/22	10 10		0.025	0.370	0.038	0.041	0.090
73/08/19	08 45		0.260	0.500	0.042	0.052	0.100
73/09/20	15 50		0.016	0.440	0.073	0.046	0.120
73/10/19	12 45		0.011	0.250	0.037	0.019	0.050
73/11/18	10 00		0.048	0.500	0.020	0.016	0.025
73/12/13	17 00		0.088	0.200	0.014	0.060	0.085
74/01/04	09 15		0.160	0.400	0.040	0.096	0.145
74/01/18	09 30		0.360	0.400	0.028	0.068	0.115
74/02/01	13 45		1.090	0.600	0.090	0.100	0.150

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/04/27

4506E1
33 36 00.0 080 34 30.0 4
HALFWAY SWAMP CREEK
45 15 ELLOREE
T/LAKE MARION 030892
ST HWY 47 BRDG 3 MI S OF LONE STAR
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/02/27	14 45		0.730	0.270	0.042	0.017	0.035
73/03/20	09 20		0.500	0.400	0.005K	0.038	0.070
73/04/18	14 10		0.580	0.320	0.026	0.052	0.090
73/05/21	10 35		0.300	0.300	0.020	0.058	0.085
73/06/17	09 20		0.750	0.880	0.031	0.072	0.123
73/07/22	10 25		0.210	0.320	0.032	0.050	0.110
73/08/19	09 05		0.170	0.330	0.030	0.054	0.110
73/09/20	18 00		0.220	0.270	0.039	0.034	0.150
73/10/19	13 00		0.260	0.200	0.031	0.034	0.065
73/11/18	10 15		0.184	0.200	0.016	0.020	0.040
73/12/13	17 15		0.360	0.300	0.016	0.036	0.055
74/01/04	09 25		0.320	0.200	0.024	0.048	0.070
74/01/18	09 45		0.352	0.900	0.040	0.040	0.080
74/02/01	14 00		0.504	0.300	0.025	0.055	0.095

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/04/27

4506F1
33 40 00.0 080 36 30.0 4
WARLEY CREEK
45 15 ELLOREE
T/LAKE MARION 030892
ST HWY 47 BRDG 3 MI N OF LONE STAR
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/02/27	15 00		0.990	0.420	0.056	0.016	0.040
73/03/20	09 30		0.840	0.440	0.016	0.011	0.040
73/04/18	14 20		0.860	0.300	0.042	0.027	0.055
73/05/21	10 45		0.790	0.370	0.035	0.021	0.045
73/06/17	09 30		0.336	1.200	0.054	0.050	0.145
73/07/22	10 35		0.810	0.320	0.048	0.018	0.060
73/08/19	09 20		0.540	0.440	0.034	0.021	0.070
73/09/20	18 15		0.660	1.600	0.960	0.024	0.095
73/10/19	13 10		1.320	0.250	0.105	0.018	0.065
73/11/18	10 30		1.260	0.400	0.064	0.016	0.036
73/12/13	17 20		1.180	0.500	0.120	0.024	0.045
74/01/04	09 40		1.120	0.300	0.108	0.024	0.060
74/01/18	10 00		1.100	0.300	0.084	0.020	0.075
74/02/01	14 20		1.100	0.300	0.085	0.030	0.070

STORET RETRIEVAL DATE 76/04/27

4506G1
33 45 30.0 080 38 30.0 4
CONGAREE RIVER
45 CALHOUN CO HWY M
I/LAKE MARION 030891
US HWY 601 BRDG 3 MI E OF FORT MOTTE
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/02/27	15 15		0.390	0.230	0.069	0.029	0.070
73/03/20	09 45		0.240	0.720	0.035	0.048	0.140
73/04/18	14 30		0.252	0.270	0.028	0.026	0.070
73/05/21	11 00		0.390	0.290	0.040	0.035	0.090
73/06/17	09 50		0.380		0.078	0.032	0.070
73/07/22	10 50		0.350	0.270	0.032	0.032	0.080
73/08/19	09 35		0.410	0.270	0.050	0.035	0.090
73/09/20	18 20		0.130	0.600	0.060	0.050	0.145
73/10/19	13 15		0.480	0.400	0.130	0.044	0.160
73/11/18	10 45		0.312	0.250	0.028	0.036	0.100
73/12/13	17 35		0.320	0.200	0.044	0.036	0.080
74/01/04	10 00		0.250	0.400	0.028	0.048	0.240
74/01/18	10 10		0.288	0.300	0.040	0.024	0.085
74/02/01	14 35		0.264	0.400	0.020	0.035	0.085

STORET RETRIEVAL DATE 76/04/27

4506H1
33 57 00.0 080 37 30.0 4
WATEREE RIVER
45 SUMTER CO HWY MA
I/LAKE MARION 030891
US HWYS 76&378 BRDG 15 MI W OF SUMTER
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/02/09	13 35		0.220	0.540	0.080	0.058	0.110
73/03/11	14 30		0.280	0.540	0.078	0.056	0.120
73/04/14	10 00		0.260	0.450	0.063	0.046	0.105
73/05/12	12 40		0.250	0.800	0.107	0.052	0.110
73/06/15	11 00		0.300	0.710	0.088	0.052	0.105
73/07/17	14 30		0.330	1.680	0.100	0.031	0.100
73/08/17	15 00		0.300	1.400	0.092	0.029	0.075
73/09/17	15 45		0.220	1.050	0.220	0.052	0.102
73/10/17	14 25		0.310	2.300	0.260	0.046	0.090
73/11/20	15 00		0.352	0.400	0.060	0.064	0.110
74/01/09	11 35		0.384	0.600	0.116	0.076	0.135
74/02/06	12 10		0.440	0.400	0.090	0.065	0.125

STORET RETRIEVAL DATE 76/04/27

4506J1
33 39 00.0 080 30 00.0 4
SPRING GROVE
45 CLARENDON CO HWY
T/LAKE MARION 030892
ST HWY 76 BRDG 9 MI W OF SOMMERTON
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/02/24	09 40		0.510	0.400	0.034	0.013	0.030
73/03/24	10 00		0.340	2.600	0.138	0.013	0.045
73/04/14	09 45		0.378	0.480	0.048	0.018	0.040
73/05/21	16 35		0.357	0.560	0.034	0.033	0.060
73/06/21	16 10		0.378	1.200	0.039	0.039	0.075
73/07/20	15 45		0.400	0.540	0.032	0.035	0.065
73/08/12	13 00		0.360	0.600	0.030	0.033	0.065
73/09/17	14 15		0.105	1.380	0.088	0.044	0.090
73/10/22	14 30		0.075	1.450	0.063	0.046	0.330
73/11/26	10 15		0.016	0.400	0.024	0.016	0.170
73/12/20	14 30		0.160	0.700	0.032	0.020	0.035
74/01/17	10 55		0.224	0.500	0.060	0.024	0.040
74/01/31	10 00		0.240	0.600	0.056	0.056	0.110
74/02/15	12 50		0.560	0.400	0.035	0.015	0.020

STORET RETRIEVAL DATE 76/04/27

4506K1
33 35 00.0 080 24 30.0 4
JACKS CREEK
45 CLARENDON CO HWY
T/LAKE MARION 030892
RD BRDG CONNETING HWY 257&7G
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/02/24	10 05		0.550	0.412	0.025	0.007	0.015
73/03/24	10 25		0.336	0.530	0.011	0.010	0.035
73/04/14	10 05		0.390	0.560	0.033	0.017	0.040
73/05/21	17 15		0.500	0.720	0.032	0.024	0.040
73/06/21	16 30		0.400	0.615	0.040	0.034	0.070
73/07/20	16 25		0.410	0.330	0.027	0.038	0.065
73/08/12	13 15		0.336	0.420	0.035	0.028	0.055
73/09/17	14 45		0.290		0.094	0.021	0.050
73/10/22	15 00		0.300	0.450	0.037	0.023	0.050
73/11/26	10 40		0.260	0.500	0.020	0.016	
73/12/20	15 00		0.640	0.300	0.028	0.020	0.030
74/01/17	11 15		0.370	0.400	0.020	0.024	0.045
74/01/31	10 20		0.232	0.500	0.032	0.032	0.075
74/02/15	13 20		0.352	0.400	0.015	0.015	0.030

STORET RETRIEVAL DATE 76/04/27

4506L1
33 33 00.0 080 21 30.0 4
TAWCAW CREEK
45 15 SUMMERTON
T/LAKE MARION 030892
END OF RD OFF HWY 127 4 MI S SUMMERTON
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/02/24	11 00		1.360	1.100	0.050	0.044	0.070
73/03/24	10 40		0.960	0.500	0.038	0.058	0.095
73/04/14	10 20		1.120	0.690	0.042	0.078	0.120
73/05/21	18 30		0.640	1.700	0.087	0.294	0.370
73/06/21	16 50		0.830	0.740	0.058	0.105	0.175
73/07/20	16 50		0.700	0.500	0.105	0.210	0.250
73/08/12	13 27		0.790	2.400	0.176	0.240	0.290
73/09/20	15 15		0.580	1.150	0.037	0.365	0.430
73/10/22	15 30		0.410	1.300	0.034	0.500	0.640
73/11/26	11 00		0.032	1.000	0.032	0.830	0.960
73/12/20	14 15		0.690	0.900	0.200	0.176	0.210
74/01/17	11 30		0.890	0.500	0.080	0.120	0.160
74/01/31	10 45		0.900	0.500	0.028	0.056	0.085
74/02/15	13 45		0.650	0.600	0.020	0.040	0.080

STORET RETRIEVAL DATE 76/04/27

4506XA PD4506XA P001250
33 32 30.0 080 33 58.0 4
ELLOREE
45 15 ELLOREE
T/LAKE MARION 030892
BIG POPLAR CREEK
11EPALES 2141204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/06/22	09 00		0.050	15.400	0.550	3.650	4.300		
73/07/22	09 00		0.020	7.000	0.140	3.000	4.100		
73/08/22	09 00		0.042	10.500	1.300	4.600	4.700		
73/09/22	09 00		0.018	16.800	1.100	8.000	9.100		
73/10/24	09 00		0.126	10.500	0.200	9.300	10.000		
73/11/23	09 00		0.230	15.500	0.370	9.200	11.000		
73/12/24	09 00		0.580	12.000	0.860	9.900	9.900		
74/01/22	09 00		0.200	27.000	1.700	10.000	12.500		
74/02/22	09 00		2.160	9.400	1.600	3.500	4.500		
74/03/22	09 00		0.560	7.200	1.050	3.500	4.700		
74/04/22	09 00		1.000	3.300	0.530	3.500	4.450		
74/05/22	10 00		0.120	16.000	0.440	5.200	7.200		
74/06/22	09 00		0.120	3.000	0.078	3.800	4.700		